

Evaluation of the local atrial function by regional speckle tracking imaging using intracardiac echocardiography

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Background: It has been reported that low voltage areas and conduction abnormalities detected by electrophysiology catheters in the left atrium (LA) represent regional degeneration and fibrosis of the atrium and are related to a poor atrial fibrillation (AF) ablation outcome. Assessment of the local atrial function is clinically useful because atrial degeneration does not occur uniformly throughout the atrium. Though evaluating the global atrial function using speckle tracking imaging (STI) by transthoracic echocardiography (TTE) has been attempted, TTE does not have a sufficient image quality to assess local atrial STI.

Purpose: To evaluate the local atrial function by STI using intracardiac echocardiography (ICE) and to elucidate the characteristics of the STI in normal and abnormal voltage regions in the LA.

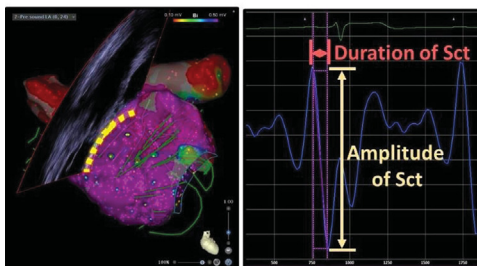
Methods: We included 9 patients undergoing AF ablation with written informed consent for this prospective observational study. After pulmonary vein isolation, we performed voltage mapping of the LA in sinus rhythm using a CARTO system (Biosense). Abnormal regions and normal regions were defined as those with low voltage areas (<0.5 mV) and those with normal voltages, respectively. Echo images were recorded by an ACUSON SC2000 (Siemens) and SOUNDSTAR catheter (Biosense). We inserted the SOUNDSTAR catheter into the LA to obtain clear images, recorded the

STI of the anterior and inferior wall, and performed an offline analysis of the atrial strain with an eSie VVI work station (Siemens) and the LA voltage data with CARTO system at each site simultaneously (left figure). We compared the strain during the atrial contraction phase (Sct) between the normal and abnormal regions.

Results: Among the study population, 5 patients had low voltage areas in the LA. We evaluated the STI at 26 normal regions and 44 abnormal regions. The typical regional speckle tracking waveform in the normal region was similar to a jugular vein pressure waveform (right figure). There was a difference in the amplitude of the Sct between the groups; it was significantly smaller in the abnormal regions (normal and abnormal regions, $9.8 \pm 5.0\%$ and $5.6 \pm 3.8\%$, $p=0.0001$). The duration of the Sct was significantly more prolonged in the abnormal regions than normal regions (98.8 ± 26.3 ms and 118.2 ± 33.9 ms, $p=0.015$).

Conclusions: This pilot study demonstrated that the local atrial function was evaluable by STI using ICE and that the regional strain tracking waveform during the atrial contraction phase in abnormal voltage regions was smaller and more prolonged than that in normal regions. An evaluation of the regional STI with an ICE may be useful to detect regional abnormalities of the atrium.

Left: Voltage map and ICE image of the LA. The dotted line indicates the site where regional speckle tracking was evaluated. Purple color represents normal voltage. **Right:** Typical waveform in a normal region.



Representative case